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Three Essays on Labor Force Participation Rates Among the Fifty States, with Empirical Tests Using Panel Data

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THREE ESSAYS ON LABOR FORCE PARTICIPATION RATES AMONG THE FIFTY STATES, WITH EMPIRICAL TESTS USING PANEL DATA

by

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ABSTRACT

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This dissertation examined the theoretical foundations of an individual's labor force participation decision. Further, this dissertation provided empirical analysis of the impact of state tax rates, the duration of unemployment, and household size on male, female, and combined labor force participation rates of the fifty states from 1985 to 1990. Empirical tests showed that: 1) no significant relationship existed between tax variables and participation rates; 2) the duration of unemployment was positively related with participation rates while unemployment was negatively related; 3) service sector growth was positively correlated with longer durations of unemployment; and 4) household size was negatively related with female participation, although no significant

relationship existed between household size and male participation rates. (98 pages)

CHAPTER I

INTRODUCTION

The decision by individuals to participate in the labor force affects household consumption, non-market household production of goods and services, leisure, and other psychological dimensions which combine to create total household utility. This being the case, labor force participation decisions are often determined jointly in an interdependent process between spouses, wherein one's individual utility is partially a function of the utility of those with whom he/she lives (Altug and Miller, 1990; Blau and Grossberg, 1991; Chiappori, 1988; Coyte, 1986; Eaton and Quandt, 1983; Edwards, 1989; Felder, 1988; Gould and Saupe, 1989; Hausman and Ruud, 1984; Kaufman, 1989; Keeley, 1981; MaCurdy et al., 1990; Tokle and Huffman, 1991).

The purpose of this chapter is to establish a general theoretical basis for the labor force participation decision. The following discussion shows that participation decisions are derived from individual utility functions, and are related to the market hours decision.

A. The Theoretical Basis of Participation

Using a specific example, the ith individual within a household maximizes his or her utility:

(1) $$U_i = f(l_i, C_i, U_j)$$

where l_i is leisure time, C_i is the value of the individual's consumption, and U_j is the utility of the jth person(s) in the household. Including the utility of the jth person forces interdependence of utility among family members.

Leisure time within the utility function is simply defined as:

(2) $$l_i = T - (T_{iw} + T_{iHP})$$

where T is total time available, T_w is time spent in wage earning, and T_{iHP} is time spent in individual non-wage household production of goods and services, noting that some of l_i and T_{iHP} may be time spent jointly with other household members.

Individual consumption, C_i, is composed of purchased goods and services, x_i, and the money value of goods and services produced by the household, Z_i. The value of C_i can be expressed as:

(3) $$C_i = Px_i + Z_i$$

where P is the price of consumer goods and services. The value of Z_i is assumed to be equal to the opportunity costs (disposable wages forgone) associated with the hours spent on household production, $Z_i = w_i' T_{iHP}$, where prime values indicate disposable wages and income. The value of household production of goods and services can be expressed as:

(4) $$Z = w_i' T_{iHP} + w_j' T_{jHP}$$

which implies that $Z = Z_i + Z_j$.

A production constraint is imposed on (4) through the time identity in (2). A budget constraint is imposed on consumption of x_i in that

(5) $$Px_i = C_{p_i} = Y_d - (S + C_{pj}),$$

where Y_d is the disposable income of the household, S is household saving, and C_{pj} is purchased consumption by the jth person(s).

The time constraint is directly tied to a budget constraint

(6) $$Y_d = ((T_{iw} w_i + T_{jw} w_j) + Y_{tr} + Y_a) - Taxes$$

where disposable household income depends directly on the time allocated to market hours by the ith and jth persons, the respective wages of these persons (w_i and w_j), transfers (Y_{tr}), asset income (Y_a), and taxes. Asset income in time period t can be expressed as

(7) $$Y_{a_{(t)}} = (Y_{a_{(t-1)}} + S_{(t-1)} - C_{a_{(t)}})\, r_{(t)} - Taxes_{(t)},$$

where C_a is consumption of wealth, which can be assumed to be a function of unemployment, position in life-cycle, and duration of unemployment. The risk-free component of the interest rate (r) is typically determined by the Treasury when it issues short-term securities, and is therefore exogenous.

The remainder of the interest rate is a function of the relative risk involved in the household asset portfolio.

Totally differentiating the dependent variables with respect to all related variables yields:

(from (1)):

(8) $$dU_i = \left(\frac{\partial U_i}{\partial l_i}\right) dl_i + \left(\frac{\partial U_i}{\partial C_i}\right) dC_i + \left(\frac{\partial U_i}{\partial U_j}\right) dU_j$$

(from (2)):

(9) $$dl_i = \left(\frac{\partial l_i}{\partial T_{iw}}\right) dT_{iw} + \left(\frac{\partial l_i}{\partial T_{iHP}}\right) dT_{iHP}$$

(from (3)):

(10) $$dC_i = \left(\frac{\partial C_i}{\partial P}\right) dP + \left(\frac{\partial C_i}{\partial x_i}\right) dx_i + \left(\frac{\partial C_i}{\partial Z_i}\right) dZ_i$$

(from (4)):

(11) $$dZ = \left(\frac{\partial Z}{\partial w_i}\right) dw_i + \left(\frac{\partial Z}{\partial T_{iHP}}\right) dT_{iHP} + \left(\frac{\partial Z}{\partial w_j}\right) dw_j + \left(\frac{\partial Z}{\partial T_{jHP}}\right) dT_{jHP}$$

Totally differentiating the ith individual's share of consumption of purchased goods (from (5)) yields:

(12) $$d(C_{p_i}) = \left(\frac{\partial C_{p_i}}{\partial Y_d}\right) dY_d + \left(\frac{\partial C_{p_i}}{\partial S}\right) dS + \left(\frac{\partial C_{p_i}}{\partial C_{pj}}\right) dC_{pj}$$

which is directly related to the total differential of disposable income (from (6)):

$$dY_d = \left(\frac{\partial Y_d}{\partial T_{iw}}\right) dT_{iw} + \left(\frac{\partial Y_d}{\partial w_i}\right) dw_i + \left(\frac{\partial Y_d}{\partial T_{jw}}\right) dT_{jw} + \left(\frac{\partial Y_d}{\partial w_j}\right) dw_j + \left(\frac{\partial Y_d}{\partial Y_{tr}}\right) dY_{tr} + \left(\frac{\partial Y_d}{\partial Y_a}\right) dY_a + \left(\frac{\partial Y_d}{\partial (Tax)}\right) d(Tax) \quad \textbf{(13)}$$

where transfer income (Y_{tr}) can include Social Security and public or private welfare payments. The total differential of asset income (from (7)) is:

$$dY_a = \left(\frac{\partial Y_a}{\partial Y_{a_{(t-1)}}}\right) dY_{a_{(t-1)}} + \left(\frac{\partial Y_a}{\partial S_{(t-1)}}\right) dS_{(t-1)} + \left(\frac{\partial Y_a}{\partial C_a}\right) dC_a + \left(\frac{\partial Y_a}{\partial r}\right) dr + \left(\frac{\partial Y_a}{\partial (Tax)}\right) d(Tax) \quad \textbf{(14)}$$

The hypothesized signs of the partial derivatives listed in total differentials (8) to (14) are:

from (8):	$\partial U_i/\partial l_i <=> 0$;	$\partial U_i/\partial C_i > 0$;	$\partial U_i/\partial U_j > 0$;
from (9):	$\partial l_i/\partial T_{i*} < 0$;		
from (10):	$\partial C_i/\partial P < 0$;	$\partial C_i/\partial x_i > 0$;	$\partial C_i/\partial Z_i > 0$;
from (11):	$\partial Z/\partial T_{iHP} > 0$;	$\partial Z/\partial T_{jHP} > 0$;	$\partial Z/\partial w_i > 0$;
	$\partial Z/\partial w_j > 0$;		
from (12):	$\partial C_{pi}/\partial Y_d > 0$;	$\partial C_{pi}/\partial S < 0$;	$\partial C_{pi}/\partial C_{pj} < 0$;
from (13):	$\partial Y_d/\partial T_{iw} > 0$;	$\partial Y_d/\partial w_i > 0$;	$\partial Y_d/\partial T_{jw} > 0$;
	$\partial Yd/\partial w_j > 0$;	$\partial Y_d/\partial Y_{tr} > 0$;	$\partial Y_d/\partial Y_a > 0$;
	$\partial Y_d/\partial Tax < 0$;		
from (14):	$\partial Y_a/\partial Y_{a(t-1)} > 0$;	$\partial Y_a/\partial S_{t-1} > 0$;	$\partial Y_a/\partial C_a < 0$;
	$\partial Y_a/\partial r > 0$;	$\partial Y_a/\partial Tax < 0$.	

The question now becomes, at what point do individuals within a household enter the work force? The answer depends on the individual reservation wage, which is defined as the expected wage that increases the individual's time allocated to the market (T_{iw}) from zero to some infinitesimal value greater than zero. The reservation wage is the marginal rate of substitution between C_{pi} and l_i ($\partial C_{pi}/\partial l_i$), where $l_i \rightarrow l_i^*$, and l_i^* is equal to $T - (T_{iHP}^* + T_{iw}^*)$.

Optimal leisure time (l_i^*) is found by maximizing individual utility in equation (1), subject to budget and time constraints. The time and money constraints can be expressed in a single full-income equation as

$$F = w_i' l_i + P x_i + w_i' T_{iHP} + w_j' l_j + P x_j + w_j' T_{jHP} = (w_i' + w_j') T + Y_n'. \tag{15}$$

Where prime values are net of taxes, this implies that the expenditures on goods and services plus expenditures on leisure plus the value of household production are equal to the total value of time for the ith and jth persons, plus non-wage income.

Assuming that the utility of the jth person(s) in equation (1) is symmetrical to the specification presented for the ith person(s), the optimization problem becomes

$$\mathcal{L} = f(l_i, C_i, U_j) + \lambda (F - w_i' l_i - P x_i - w_i' T_{iHP} - w_j' l_j - P x_j - w_j' T_{jHP}) \tag{16}$$

The first order conditions from this Lagrangian, assuming an interior solution and solving for λ, are

(17) $$\frac{\frac{\partial U_i}{\partial l_i} + \frac{\partial U_i}{\partial U_j}\frac{\partial U_j}{\partial l_i}}{w_i'} = \lambda$$

(18) $$\frac{\frac{\partial U_i}{\partial P} + \frac{\partial U_i}{\partial U_j}\frac{\partial U_j}{\partial P}}{x_i + x_j} = \lambda$$

(19) $$\frac{\frac{\partial U_i}{\partial x_i} + \frac{\partial U_i}{\partial U_j}\frac{\partial U_j}{\partial x_i}}{P} = \lambda$$

(20) $$\frac{\frac{\partial U_i}{\partial T_{iHP}} + \frac{\partial U_i}{\partial U_j}\frac{\partial U_j}{\partial T_{iHP}}}{w_i'} = \lambda$$

(21) $$\frac{\frac{\partial U_i}{\partial l_j} + \frac{\partial U_i}{\partial U_j}\frac{\partial U_j}{\partial l_j}}{w_j'} = \lambda$$

(22) $$\frac{\frac{\partial U_i}{\partial x_j} + \frac{\partial U_i}{\partial U_j}\frac{\partial U_j}{\partial x_j}}{P} = \lambda$$

(23) $$\frac{\frac{\partial U_i}{\partial T_{jHP}} + \frac{\partial U_i}{\partial U_j}\frac{\partial U_j}{\partial T_{jHP}}}{w_j'} = \lambda .$$

(24) $$\frac{\frac{\partial U_i}{\partial w_i'} + \frac{\partial U_i}{\partial U_j}\frac{\partial U_j}{\partial w_i'}}{l_i + T_{iHP}} = \lambda .$$

(25) $$\frac{\frac{\partial U_i}{\partial w_j'} + \frac{\partial U_i}{\partial U_j}\frac{\partial U_j}{\partial w_j'}}{l_j + T_{jHP}} = \lambda .$$

and

(26) $$\frac{\partial \mathcal{L}}{\partial \lambda} = F - [w_i' l_i - Px_i - w_i' T_{iHP} - w_j' l_j - Px_j - w_j' TjHP] ,$$

where λ is the marginal utility of full income.

Given these first-order conditions, we can solve for the ith individual's reservation wage through the first partial of the Lagrangian with respect to leisure, where $l_i = T'$, and $T' = T - T_{iHP}^*$

(27) $$w_{Ri} = \frac{\frac{\partial U_i}{\partial l_i} + \frac{\partial U_i}{\partial U_j}\frac{\partial U_j}{\partial l_i}\Big|_{l_i = T'}}{\lambda} .$$

By manipulating this optimization problem, we can derive optimal market hours, saving and non-wage income from optimal consumption, leisure, and household production. All of these values can be combined to express optimal values of consumption as

(28) $$Px_i^* = ((T_{iw}^* w_i' + T_{jw}^* w_j') + Y_n^{*\prime}) - S^* - Px_j^* ,$$

where the ith person's optimal consumption of purchased goods depends directly on the optimal market hours and disposable wage of the ith and jth persons, optimal non-wage disposable income, optimal saving, and the jth person's optimal consumption of purchased goods. Solving (28) for $T_{i_w}^*$ yields:

(29) $$T_{iw}^* = w_i^{-1'}[P(X_i^* + X_j^*) - T_{jw}^* w_j' - Y_n^{*'} + S^*].$$

The total differential of equation (29) becomes:

(30) $$dT_{iw}^* = \left(\frac{\partial T_{iw}^*}{\partial w_i'}\right) dw_i' + \left(\frac{\partial T_{iw}^*}{\partial P}\right) dP + \left(\frac{\partial T_{iw}^*}{\partial x_i^*}\right) dx_i^* + \left(\frac{\partial T_{iw}^*}{\partial T_{jw}^*}\right) dT_{jw}^* + \left(\frac{\partial T_{iw}^*}{\partial w_j'}\right) dw_j' + \left(\frac{\partial T_{iw}^*}{\partial Y_n^{*'}}\right) dY_n^{*'} + \left(\frac{\partial T_{iw}^*}{\partial S^*}\right) dS^* + \left(\frac{\partial T_{iw}^*}{\partial x_j^*}\right) dx_j^*.$$

where $\partial T_{iw}^*/\partial w_i' <=> 0$. Further, the signs of the remaining partial derivatives are:

$$\partial T_{iw}^*/\partial Y_n^* < 0; \qquad \partial T_{iw}^*/\partial w_j' < 0;$$

$$\partial T_{iw}^*/\partial C_{pi}^* > 0; \qquad \partial T_{iw}^*/\partial S^* > 0;$$

$$\partial T_{iw}^*/\partial T_{jw}^* < 0; \qquad \partial T_{iw}^*/\partial C_{pj}^* > 0.$$

As stated above, if $T_{iw}^* > 0$, then the ith person is in the labor force. It is important to note that T_{iw}^* is the amount of time supplied to the market. Whether or not the person is actually employed is irrelevant to the question of participation. However, influences on the initial increment of market time provided as the expected wage rises above the reservation wage can be show in a Slutsky decomposition.

The system of equations provided above implies that market hours are a function of wages and the full income

definition provided in (15), so that $T_{iw} = f(w_i', w_j', Y_n')$. The Slutsky is derived directly as a total differential of this expression

$$dT_{iw} = \frac{\partial T_{iw}}{\partial w_i'}\Big|_{(u-\bar{u})} dw_i' + \frac{\partial T_{iw}}{\partial w_j'}\Big|_{(u-\bar{u})} dw_j' + \frac{\partial T_{iw}}{\partial Y_n'} [T_{iw} dw_i' + T_{jw} dw_j' + dY_n], \tag{31}$$

which shows that the total change in market hours is composed of the own-wage compensated substitution effect plus the cross-wage compensated substitution effect, plus the full income effect (Keeley, 1981). It is important to note that changes in the jth person's wages enter into the ith person's budget constraint as a change in non-wage income (private transfer payments). This occurs because of the pooling of income that occurs in households.

As was shown above in (30), the first partial derivative of T_{iw} with respect to Y_n' is negative. We must also assume that the sign of the utility held constant (compensated) first partial derivative of T_{iw} with respect to w_i' is positive, and that wage income of the jth person is equal to zero. Further, we can now define Y_n' as $Y_a' + Y_t$, or, net asset income plus transfers (public and private).

B. Conclusion

The participation decision, while related to the market hours decision, is really quite simple in general terms. Participation will occur when the expected wage is greater

than the reservation wage. If the reservation wage falls for any reason, and the expected wage remains constant, then the likelihood of participation rises, or vice versa.

The following chapters provide a more specific analysis of the participation decision under a variety of circumstances. Chapter II provides an empirical analysis of the correlation of state taxes with labor force participation utilizing panel data. Chapter III provides an empirical analysis of the correlation of unemployment rates and the duration of unemployment with variations in participation rates. Chapter IV provides an empirical analysis of the correlation between household size and the participation decision. Chapter V provides a brief summary of the findings from each of the preceding chapters.

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CHAPTER II

A THEORETICAL ANALYSIS OF THE RELATIONSHIP BETWEEN STATE TAXES AND LABOR FORCE PARTICIPATION RATES WITH AN EMPIRICAL TEST

Much research has been done to discover how taxes affect the labor decisions of households. Initial theoretical works by Milton Friedman (1949, 1976) and the general equilibrium approach taken by Gwartney and Stroup (1983) show that when tax revenues flow back to the household in the form of transfers, there is only a compensated substitution effect. There is no income effect in this case because the tax payment is added back into household income as a non-wage public transfer of income.

Assuming for the moment that public sector spending is perceived by a representative individual in the aggregate economy as a dollar-for-dollar offset to taxes paid, we can show the change in work hours and labor force participation with the following graph. In the case of increasing taxes, the expected wage falls from w to w' as non-wage income increases from Y_n to Y_n', which increases the reservation wage. The net result is that market hours fall from T_{iw} to T_{iw}'. Further, the probability of labor force participation in the aggregate falls due to converging expected and reservation wages (see Figure 1). This of course assumes that gross real

wages and gross real asset income are held constant, and that the economy remains on a given production possibilities frontier.

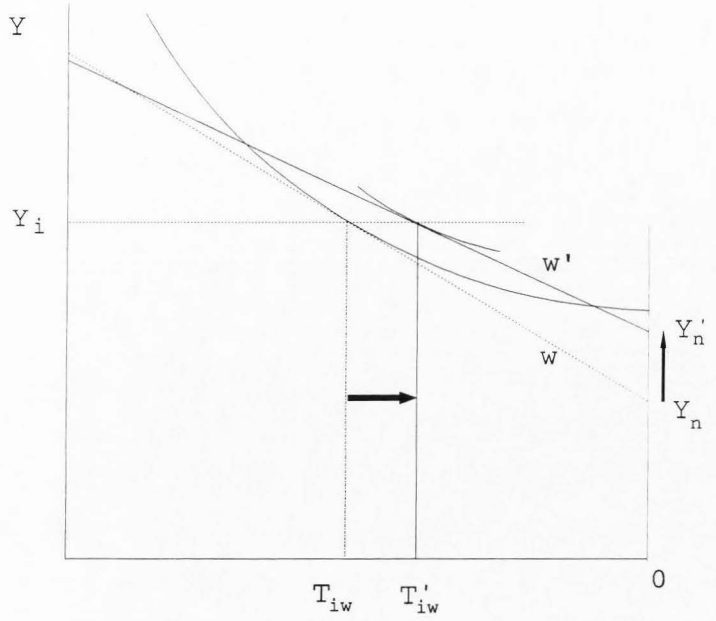

FIGURE 1. NON-WAGE INCOME COMPENSATION FOR REDUCED WAGES IN THE PRESENCE OF TAXES

Other authors (Hausman and Ruud, 1984; Triest, 1990) have empirically analyzed the effect of taxes on the labor hours supplied by men and women. Hausman and Ruud found that the elasticity associated with net wages was .26 for men and .32

for women. These low elasticity values were verified by Triest who estimated uncompensated wage elasticities for men between -.02 and .06, and uncompensated elasticities for women between .03 and .28, depending on the method used.

These low wage elasticities are taken to mean that as net wages fall due to increasing taxes, there must be an income effect which counters the dominating substitution effect hypothesized by Friedman and others. Blomquist (1988) suggests that the reason empirical researchers are deriving such low net wage elasticities is that they fail to account for the nonlinearity of the tax structure. Blomquist argues that nonlinear tax rates shift the supply curves of different income earning groups, and that the net result is an empirical estimation which is misleading and far less elastic than it should be.

On the other hand, MaCurdy et al. (1990) argue that studies which account for nonlinear taxes using a piecewise budget set in a maximum likelihood model will typically generate larger substitution and lower income elasticities than with other methods. These authors suggest that this result is not due to theory but the implicit assumptions involved in using maximum likelihood methods (i.e., forcing Slutsky conditions and inequality restrictions on Slutsky terms).

In summary, reviewing the literature does little to clarify the issue of how taxes affect the labor decisions of

households. However, in all of these studies, the point of attack or defense is related to the relative size of the income and substitution effects associated with the imposition of taxes on income, which is directly related to the extent to which tax payments flow back as transfers.

A. Theoretical Explanation of the Impact of Taxes on Labor Supply Decisions

We can generalize the impact of taxes on participation rates and work hours by maximizing a typical interdependent utility function. From this maximization process, we can create a Slutsky decomposition of the influences on market hours, and therefore participation.

The ith individual in a household maximizes the utility function:

(1) $$U_i = f(l_i, C_i, U_j)$$

where l_i is leisure time, C_i is the value of the individual's consumption, and U_j is the utility of the jth person(s) in the household. Including the utility of the jth person forces interdependence of utility between family members.

Leisure time within the utility function is simply defined as:

(2) $$l_i = T - (T_{iw} + T_{iHP})$$

where T is total time available, T_w is time spent in wage earning, and T_{iHP} is time spent in individual non-wage household production of goods and services, noting that some of l_i and T_{iHP} may be time spent jointly with other household members.

Individual consumption, C_i, is composed of purchased goods and services, x_i, and the money value of goods and services produced by the household, Z_i. The value of C_i can be expressed as:

(3) $$C_i = Px_i + Z_i$$

where P is the price of consumer goods and services. The value of Z_i is assumed to be equal to the opportunity costs (disposable wages forgone) associated with the hours spent on household production, $Z_i = w_i' T_{iHP}$, where prime values indicate disposable wages and income. The value of household production of goods and services can be expressed as:

(4) $$Z = w_i' T_{iHP} + w_j' T_{jHP}$$

which implies that $Z = Z_i + Z_j$.

A production constraint is imposed on (4) through the time identity in (2). A budget constraint is imposed on consumption of x_i in that

(5) $$Px_i = C_{p_i} = Y_d - (S + C_{pj}),$$

where Y_d is the disposable income of the household, S is household saving, and C_{pj} is purchased consumption by the jth person(s).

The time constraint is directly tied to a budget constraint

(6) $$Y_d = ((T_{iw}W_i + T_{jw}W_j) + Y_{tr} + Y_a) - Taxes$$

where disposable household income depends directly on the time allocated to market hours by the ith and jth persons, the respective wages of these persons (w_i and w_j), transfers (Y_{tr}), asset income (Y_a), and taxes. Asset income in time period t can be expressed as

(7) $$Y_{a_{(t)}} = (Y_{a_{(t-1)}} + S_{(t-1)} - C_{a_{(t)}})\, r_{(t)} - Taxes_{(t)},$$

where C_a is consumption of wealth, which can be assumed to be a function of unemployment, position in life-cycle, and duration of unemployment. The risk-free component of the interest rate (r) is typically determined by the Treasury when it issues short-term securities, and is therefore exogenous. The remainder of the interest rate is a function of the relative risk involved in the household asset portfolio.

Optimal leisure, market, and household production time can be found by maximizing individual utility in equation (1), subject to budget and time constraints. A full description of the optimization problem is not required here, rather, attention must be focused on the factors which may change optimal market hours from zero. A Slutsky decomposition is

created below to show the hypothesized impact of changing monetary factors and competing time uses.

The time and money constraints can be expressed in a single full-income equation as

$$F = w_i' l_i + w_i' T_{iw} + w_i' T_{iHP} + w_j' l_j + w_j' T_{jw} + w_j' T_{jHP} = (w_i' + w_j')\, T + Y_n'. \tag{8}$$

Where prime values are net of taxes, this implies that the expenditures on goods (the value of market time by the ith and jth persons) plus expenditures on leisure plus the value of household production are equal to the total value of time for the ith and jth persons, plus non-wage income. Therefore, the system of equations provided above implies that market, leisure, and household production hours are a function of wages and non-wage income, so that $T_{iw} = f(w_i', w_j', Y_n')$. The Slutsky is derived directly as a total differential of this expression

$$dT_{iw} = \frac{\partial T_{iw}}{\partial w_i'}\Big|_{(u=\bar{u})} dw_i' + \frac{\partial T_{iw}}{\partial w_j'}\Big|_{(u=\bar{u})} dw_j' + \frac{\partial T_{iw}}{\partial Y_n'} [T_{iw} dw_i' + T_{jw} dw_j' + dY_n], \tag{9}$$

which shows that the total change in market hours is composed of the own-wage compensated substitution effect plus the cross-wage compensated substitution effect, plus the full income effect (Keeley, 1981). It is important to understand at this point that wages of the jth person change the budget

constraint of the ith person through non-wage income (private transfers).

The first partial derivative of T_{iw} with respect to Y_n' is negative. We must also assume that the sign of the utility held constant (compensated) first partial derivative of T_{iw} with respect to w_i' is positive. We can now define Y_n' as $Y_a' + Y_t$, or, net asset income plus transfers (public and private), which are assumed to be non-taxable.

If we impose an income tax which does not discriminate between wage and non-wage income, then both non-wage income and wages are reduced, assuming there is no perceived offsetting transfer. Altering the wage alone implies both an income and substitution effect. The actual impact on hours worked due to the change in the net wage will depend on the relative dominance of the income or substitution effect, assuming no offsetting increase in transfers. Changes in non-wage income alone will only cause an income effect. Therefore, the net impact on market hours due to a simple income tax depends on the relative strength of the substitution effect due to a change in wage rates, and the income effects due to changes in asset income and wages.

The regions of substitution or income effect dominance of changing the wage rate alone can be shown best graphically, by assuming a two-dimensional indifference mapping (Figure 2) between leisure time (l_i) and disposable income (Y_d), where market time of the jth person is zero. We can assume a

constant level of nonwage income (Y_n) if no perceived transfers occur.

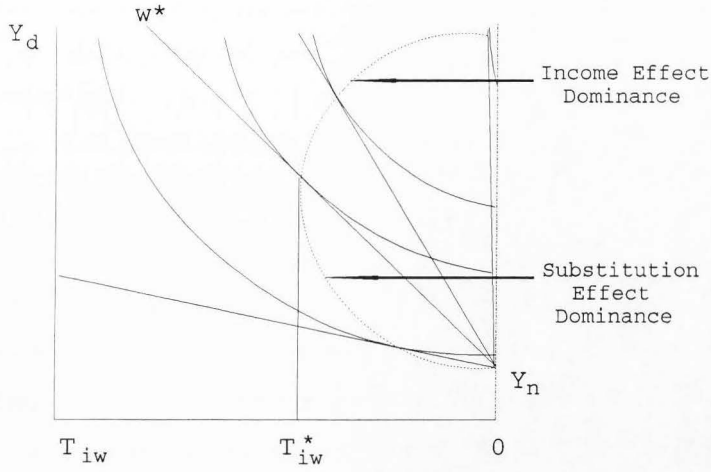

FIGURE 2. REGIONS OF DOMINANT INCOME AND SUBSTITUTION EFFECTS DUE TO CHANGING WAGE RATES

Note that as the net wage is reduced from near-infinity, market hours rise to a positive maximum at T_{iw}^* and then begin to fall toward zero, where the expected net wage is equal to the reservation wage. Where wages are inversely related to work hours, the income effect is dominant over the income effect. Where wages are directly related to work hours, the substitution effect is dominant over the income effect.

As stated earlier, changes in non-wage income will only cause an income effect. Given this information, if a particular household faces a ten percent effective tax rate, then both w_i and Y_a are reduced by ten percent, causing both a downward rotation and downward shift of the budget constraint.

If we assume that the indifference set, asset income, and expected wage are for a representative individual in a particular state, then it will be true that a distribution exists around the representative reservation wage, expected wage, and asset income. Given this, the probability of labor force participation can be expressed as

$$p(LFP) = f(wage) - g(a(Y_n)), \tag{10}$$

where f(wage) is the distribution of mean-normalized real wages and $g(a(Y_n))$ is the distribution of mean-normalized reservation wages which are a function of non-wage income. As the distribution of asset income falls, the distribution of normalized reservation wages also falls. Therefore, if the distribution of wages falls more than the distribution of reservation wages, then the probability of labor force participation will fall as the distributions converge. It is important to note that it is the absolute change in the distribution of normalized wages and reservation wages, not the percentage change, which determines changes in the participation decision. A measure of absolute normalized change for any distribution of x is

$$\Delta(f(x)) = \frac{(x_{i(t-1)} - \bar{x}_{(t-0)})}{\bar{x}_{(t-0)}} . \tag{11}$$

If the distribution of reservation wages falls more than the distribution of wages, then aggregate participation rates will rise as the distance between their respective mean values increase. Predicting whether market hours will rise or fall in these circumstances depends on whether the new after-tax wage is above or below the market-hours maximizing (optimal) net wage. If the new after-tax wage is above the optimal net wage, market hours will increase, or vice versa.

Changing the mean value of after-tax non-wage income, ceteris paribus, traces out the distribution of expected after-tax wages. Changing the mean value of expected after-tax wages, ceteris paribus, traces out the distribution of reservation wages, which are a function of after-tax non-wage income. Changing either non-wage income or wages under ceteris paribus conditions causes changes in the labor force participation rate in exactly opposite ways. Figure 3 below shows the change in the aggregate labor force participation rate as a function of the change in the mean after-tax expected wage, assuming there is no overlap in either of the distributions at the origin.

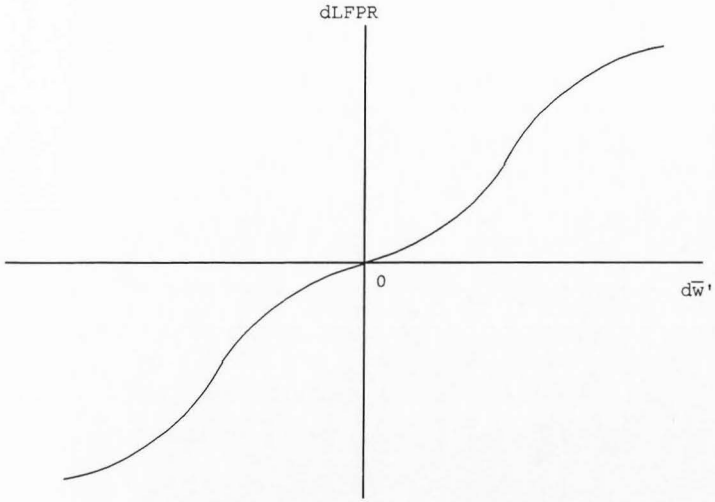

FIGURE 3. CHANGE IN AGGREGATE LFPR AS A FUNCTION OF THE CHANGE IN MEAN AFTER-TAX EXPECTED WAGE

Figure 4 below shows the change in the aggregate labor force participation rate as a function of the change in mean after-tax non-wage income, once again assuming there is no overlap between these distributions at the origin.

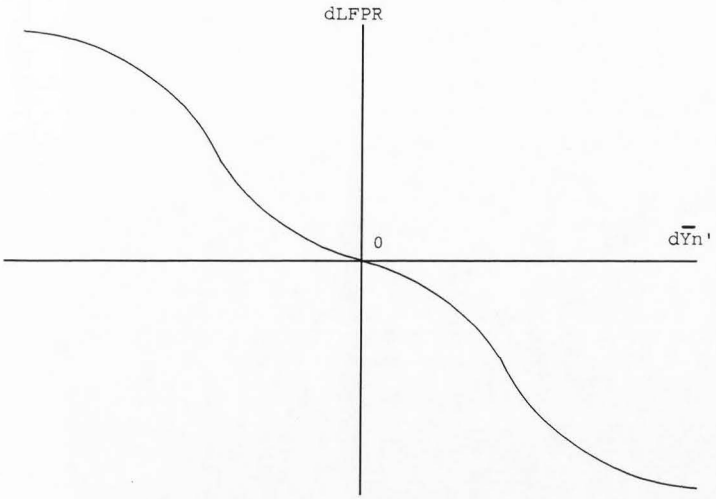

FIGURE 4. CHANGE IN AGGREGATE LFPR AS A FUNCTION OF CHANGE IN MEAN AFTER-TAX NON-WAGE INCOME

From a policy standpoint, if we impose an asset-income tax, market hours and participation rates will always rise, ceteris paribus. If a wage tax is imposed and after-tax wages are above the optimal wage, market hours will rise while participation rates fall.

If wages and asset income are simultaneously taxed at the same rate, the effect on participation rates may be directly or inversely related to changes in market hours, depending on the after-tax values of non-wage income and the expected wage.

If we make the assumption that the majority of households within a particular state have high asset income and moderate wages, imposing a tax which affects all income sources at the same rate will cause the distribution of wages to fall less than the distribution of reservation wages in absolute terms.

Market hours, therefore, may fall while participation rates rise. However, if we selectively tax households which have high non-wage income and expected after-tax wages above the optimum wage, then it is likely that market hours will rise while participation rates may rise, fall or remain constant, depending on the absolute magnitude of changes in the expected wage and non-wage income.

To summarize, the problem of predicting participation rates, and how those rates are correlated with work hours, breaks down to an analysis of the normalized absolute change in reservation wages and expected wages, and whether the after-tax expected wage is above or below the optimum wage. A high change in non-wage income and a low change in expected wages, for example, would be caused by applying a single tax rate against income that is composed mainly of non-wage income, with relatively low wage income. Possible combinations of these variables and the predicted signs are summarized in Table 1 below.

TABLE 1--THE EFFECT OF INCREASING A UNIFORM INCOME TAX ON MARKET HOURS AND LABOR FORCE PARTICIPATION, BY INCOME TYPE AND LEVEL*

Change in: Y_n	Wage	Position of After-Tax Wage	Hypothesized Effect on: Market Hours	Participation
High	High	$w > w^*$	+	+ or -
High	Low	$w > w^*$	+	+
Low	High	$w > w^*$	+	-
Low	Low	$w > w^*$	+	+ or -
High	High	$w < w^*$	+ or -	+ or -
High	Low	$w < w^*$	+ or -	+
Low	High	$w < w^*$	-	-
Low	Low	$w < w^*$	+ or -	+ or -

* Assuming Constant Indifference Set and Linear Taxes.

As shown above, there are only two cases when participation rates and hours worked are directly correlated (Low/High, $w < w^*$; High/Low, $w > w^*$), and one case where there is an inverse relationship (Low/High, $w > w^*$).

The impact of a combined wage and asset income tax on market hours for a representative individual can be shown using the three-dimensional offer surface provided in Figure 5. This representation shows market hours provided due to all possible combinations of after-tax wages and non-wage income, with the restriction that disposable non-wage income must be greater than zero.

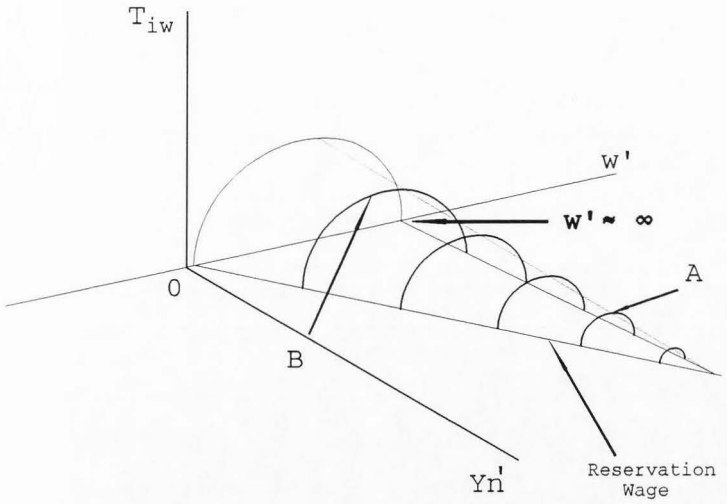

FIGURE 5. MARKET HOURS OFFER SURFACE

Moving from point A to point B causes a reduction in the after-tax wage and non-wage income, but increases the number of market hours. Further, it appears that the absolute reduction in non-wage income is greater than the absolute reduction in the wage; therefore, we may assume that participation rates will increase as well.

B. Structural Model Development

The preceding theoretical discussion showed that if tax payments do not completely flow back to households as perceived public transfers, multiple combinations of effects on participation rates and work hours are possible. As mentioned earlier, a simple test of whether representative households perceive that tax revenues are flowing back to them in the form of transfers is to examine variations in participation rates in the presence of different tax rates, controlling for changes in real income and other demographic variables.

A basic model to explain labor force participation can be developed by acknowledging that the reservation wage is a function of average non-wage income, which can be simply defined as the average transfer payment plus average asset income. Further, the expected wage for the representative individual is the average wage, conditioned by the probability of receiving that wage. The probability of receiving a given wage can be defined as one minus the unemployment rate. The discussion above assumes that the indifference set remains constant in shape and placement.

The structural model becomes

(12) $$LFPR = p(E(w), \overline{w_r}),$$

(13) $$E(w) = (1-UN)\,\overline{w},$$

(14) $$\overline{w_r} = r(\overline{Y_t}, \overline{Y_a}).$$

Given that this model is for a representative (average) individual, there exists a distribution around both the reservation and expected wages. Therefore, as these mean values start to converge, we would expect to observe greater overlap in their respective distributions, thus causing observed aggregate participation rates to fall.

As stated earlier, if one rejects the notion that only a compensated substitution effect exists, then predicting the change in participation rates due to taxes becomes somewhat more difficult. If the tax is structured in such a way that it reduces asset income more than wages, then participation rates may rise as taxes are imposed. Further, if the tax maintains the difference between the reservation wage and the expected wage, albeit at lower levels for both, then participation rates should remain constant.

With this information, the realism of the assumption that there is an exclusive compensated substitution effect can be tested, by testing whether a significant relationship exists between tax rates and participation rates. The null hypothesis in this case being that the coefficient associated with taxes is less than zero.

C. The Empirical Model

Panel data for all fifty states over the period 1988 to 1990 were used for this study. When testing for correlation between tax rates and participation rates with these data, it is important to control for differences in populations that may change the shape and placement of the indifference set between states. A number of social variables were tested; however, the most significant of these included the percentage of manufacturing workers who are union members (PUMM); percentage of the states eligible population classified as black or hispanic (MIN); and percentage of the state population with four-year college degrees or more (EDUC). Surprisingly, the percentage of the population over the age of 65 was not significant over this period.

The budget constraint was somewhat difficult to set up because asset income variables by state were not available. Also, all coefficients associated with real wage rates were insignificant. Therefore, it was decided that real median household income (MHI) should be used, because it incorporates both asset and wage income. Including MHI required that the study be limited to the period 1988 to 1990 because previous years of MHI are calculated differently and are not directly comparable.

Given that median household income, unemployment rates, and participation rates are simultaneously determined in the market, fitted values of median household income and unemployment were first obtained through multivariate least squares to account also for correlation between the error terms. The set of exogenous variables that were used for both included eight dummy variables to represent the nine census regions; percentage of employment in the manufacturing, service, and agricultural sectors; percentage of the population over 65; EDUC; PUMM; MIN; dummy variable designating whether the state is a right-to-work state; state employment ratio; state population; and the percentage of unemployed who are out of work for fifteen weeks or more. Both estimations displayed a good fit: $R^2 = .86$ for the unemployment equation; and $R^2 = .88$ for the median household income equation.

Effective tax rates were calculated from the tax burdens for a family of four with gross income of $25,000 for sales (STAX), property (PTAX), and income taxes (YTAX), for the largest city in each state. A composite of all of the above taxes, plus automobile licensing fees, was also tested (TAX). Local option sales taxes were not included in the rates to allow for statewide comparison. Property tax burdens are difficult to extrapolate to a statewide comparison due to the fact that local government entities may each have a different property tax rate structure, and that property tax burdens are

as much a function of property values as tax rates. Therefore, caution should be used when examining the impact due to property taxes.

All data were analyzed using TSP International, version 4.2, which provided many advantages in that it automatically calculates fixed and random effect models. Each tax rate was included into the basic model individually in a separate run. As one might expect for this short time period, the fixed-effects model, as opposed to the random-effects model, proved to be the appropriate specification in each case, as shown by the Hausman specification error test. The probability of error, given the chi-square distribution of the test, was always less than .0001. Further, an F-statistic testing whether the intercepts for all states were equal showed that there was a significant difference between regular OLS estimates and the fixed effect estimates. The probability of error for the test was less than .0001 in all cases.

D. Results

The coefficients associated with all of the effective tax rates were insignificant at the .05 level. A separate analysis of the labor force participation rates of men and women were also performed using the same explanatory variables. There was no deviation from the results reported for the aggregate case. Estimated coefficients for all variables are shown in Table 2 below.

TABLE 2--ECONOMETRIC RESULTS OF FIXED-EFFECTS MODELS PREDICTING LABOR FORCE PARTICIPATION RATES AS A FUNCTION OF TAXES AND OTHER VARIABLES

Model	Variable	Coefficient	t-statistic
Dependent Variable: LFPR			
Income Tax	MHIH	.0000074	6.94
(R^2=.59)	UNH	- .486	-4.97
	PUMM	-2.21	-3.07
	MIN	.158	2.69
	EDUC	.246	2.02
	YTAX	.530	1.84
Sales Tax	MHIH	.0000076	7.06
(R^2=.58)	UNH	- .457	-4.55
	PUMM	-2.24	-3.08
	MIN	.14	2.43
	EDUC	.209	1.54
	STAX	.128	.85
Property Tax	MHIH	.0000075	7.01
(R^2=.58)	UNH	- .479	-4.84
	PUMM	-2.21	-3.03
	MIN	.143	2.42
	EDUC	.257	2.09
	PTAX	- .158	-1.13
Total Tax	MHIH	.0000075	6.98
(R^2=.58)	UNH	- .471	-4.73
	PUMM	-2.27	-3.09
	MIN	.147	2.47
	EDUC	.256	2.01
	TAX	.0046	.06

E. Interpretation of Results

The signs associated with each of the variables, with the exception of taxes, can be explained using some combinations of economic theory. One would expect that as median household income rises that the majority of the cause for that rise is

increasing wages, since most median households have very little asset income. This implies that the expected wage is rising relative to the reservation wage, which would then increase the participation rate.

As discussed earlier, increasing unemployment rates decrease the expected wage toward the reservation wage, and thus the negative sign. Higher percentages of union membership being negatively correlated with participation rates is understandable due to the fact that union members have a higher probability of strikes and work stoppages, as well as layoffs in the manufacturing sector in general during this period, thus reducing the expected wage, causing the negative sign.

The positive sign associated with larger minority populations can be explained if we assume that minority groups have extremely low or negative asset income on average, thus causing higher participation rates. The positive sign associated with education levels can be explained by acknowledging that persons with higher levels of education also have higher opportunity costs associated with leisure, and, higher wages.

We can infer a number of things from the insignificance of all of the tax coefficients, including the rejection of the null hypothesis of this paper, that higher taxes are always correlated with a lower participation rate, after controlling for monetary income. From the results presented above, we can

infer that people do not perceive the public benefits provided at the state level, where public benefits are more visible as opposed to federal benefits, as transfer income. Quite the contrary, the signs of the tax coefficients for income, sales, and total, while insignificant, are positive rather than negative. The positive coefficient for the income tax is significant somewhere between the .05 and .10 levels, which suggests that there may be a dominant income or added-worker effect associated with higher state income taxes. If this is the case, then households are responding to higher levels of income taxation by supplying more workers to the market, presumably to maintain a given standard of living.

F. Conclusions

If all tax revenues are used to create government goods and services, but these goods and services are not all perceived by individuals as transfer income, the impact of taxes on market hours and participation rates becomes a function of income and substitution effects associated with changing expected wages, and income effects associated with changing asset income. This study does not support the notion that only a compensated substitution effect exists due to taxation. Rather, this research supports the research of Hausman and Ruud (1984) and Triest (1990), who found little or no connection between tax rates and labor supply. This research does, however, provide moderate support to the

argument that taxes may actually cause higher levels of participation due to target income earning preferences of households, which can be inferred from an added-worker effect (Lundberg, 1985).

Appendix (Chapter II)

All data related to wages, labor force participation, and employment by sector were collected from Employment and Wages: Annual Averages or Geographic Profile of Employment and Unemployment published by the Bureau of Labor Statistics. Tax data were collected from the District of Columbia which completes a yearly cross-sectional study of effective tax rates in a publication called Tax Rates and Tax Burdens in the District of Columbia: A Nationwide Comparison. Data for all remaining variables were collected from the Statistical Abstract of the United States.

Eight dummy variables were created to represent nine regions in the first stage estimation of median household income and unemployment. These regions are defined as:

Region	State
New England (REG1)	Maine
	New Hampshire
	Vermont
	Massachusetts
	Rhode Island
	Connecticut
Middle Atlantic (REG2)	New York
	New Jersey
	Pennsylvania
East North Cent. (REG3)	Ohio
	Indiana
	Illinois
	Michigan
	Wisconsin

West North Cent. (REG4)	Minnesota
	Iowa
	Missouri
	North Dakota
	South Dakota
	Nebraska
	Kansas
South Atlantic (REG5)	Delaware
	Maryland
	Virginia
	W. Virginia
	N. Carolina
	S. Carolina
	Georgia
	Florida
East So. Cent. (REG6)	Kentucky
	Tennessee
	Alabama
	Mississippi
West So. Cent. (REG7)	Arkansas
	Louisiana
	Oklahoma
	Texas
Mountain (REG8)	Montana
	Idaho
	Wyoming
	Colorado
	New Mexico
	Arizona
	Utah
	Nevada
Pacific	Washington
	Oregon
	California
	Alaska
	Hawaii

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CHAPTER III

THE RELATIONSHIP BETWEEN UNEMPLOYMENT, UNEMPLOYMENT DURATION, SERVICE SECTOR DEVELOPMENT AND LABOR FORCE PARTICIPATION RATES

During the 1980's, the service sector expanded rapidly, while manufacturing declined nationally. Regional unemployment rates soared in the so-called "Rust Belt" while service and high-tech industries did a booming business on the East and West coasts. Structural unemployment emerged as a national problem, as the number of discouraged workers increased. Stories were reported by the press about manufacturing workers being laid off from their high-paying jobs, only to find another job in the service sector at a much lower wage, sending the wife and kids into the labor force as well.

The question is, to what extent do the data support all of this news? Thompson (1977) empirically verified that simultaneity exists between service sector employment labor force participation rates, with the former being positively correlated with the latter. Nord (1989) further explained the process by which service sector employment is correlated with participation rates. Nord argued that the linking variable is underemployment, and that households provide additional workers to the market to maintain a standard of living. Nord

found a significant positive correlation between service sector employment and underemployment, as well as a positive relationship between participation rates and underemployment for the 100 largest SMSA's in 1980. These findings corroborate the story provided above.

The purpose of this research is to theoretically show how the duration of unemployment affects the participation decision, and to test whether additional persons enter the labor force as the duration of unemployment increases, as opposed to underemployment. A further test can then be performed to discover whether service-sector employment increases under these conditions using state-level panel data. We can develop some null hypotheses by evaluating an individual's market hours choices within a standard leisure-consumption opportunities context.

A. Theoretical Development of Null Hypotheses

We must first begin by decomposing the factors that influence work hours. Work hours may be derived from a typical interdependent utility function where the ith individual within a household maximizes his or her utility:

(1) $$U_i = f(l_i, C_i, U_j)$$

where l_i is leisure time, C_i is the value of the individuals consumption, and U_j is the utility of the jth person(s) in the household. Including the utility of the jth person forces interdependence of utility among family members.

Optimal leisure, market, and household production time can be found by maximizing individual utility in equation (1), subject to budget and time constraints

(2) $$l_i = T - (T_{iw} + T_{iHP})$$

(3) $$C_i = PX_i + Z_i$$

(4) $$PX_i = C_{P_i} = Y_d - (S + C_{pj}),$$

(5) $$Y_d = ((T_{iw}W_i + T_{jw}W_j) + Y_{tr} + Y_a) - Taxes$$

(6) $$Z = w_i' T_{iHP} + w_j' T_{jHP}$$

where T is total time available, T_{*_W} is market time, T_{*HP} is time spent in household production of goods and services, noting that some of l_i and T_{iHP} may be time spent jointly with other household members.

Individual consumption, C_i, is composed of purchased goods and services, x_i, and the money value of goods and services produced by the household, Z_i, where P is the price of consumer goods and services. The value of Z_i is assumed to be equal to the opportunity costs (disposable wages forgone) associated with the hours spent on household production, $Z_i = w_i' T_{iHP}$, where prime values indicate disposable wages and income. Disposable income, Y_d, is pooled for the household

where S is household saving, and C_{pj} is purchased consumption by the jth person(s). Wages for the ith and jth persons are w_i and w_j, transfers (public and private) are Y_{tr}, and asset income is Y_a. Asset income in time period t can be expressed as

$$Y_{a_{(t)}} = (Y_{a_{(t-1)}} + S_{(t-1)} - C_{a_{(t)}})\, r_{(t)} - Taxes_{(t)}, \tag{7}$$

where C_a is consumption of wealth, which can be assumed to be a function of unemployment, position in life-cycle, and duration of unemployment. The risk-free component of the interest rate (r) is typically determined by the Treasury when it issues short-term securities, and is therefore exogenous. The remainder of the interest rate is a function of the relative risk involved in the household asset portfolio.

The time and money constraints can be expressed in a single full-income equation as

$$\begin{aligned} F &= w_i' l_i + P x_i + w_i' T_{iHP} + w_j' l_j + P x_j + w_j' T_{jHP} \\ &= (w_i' + w_j')\, T + Y_n'. \end{aligned} \tag{8}$$

Where prime values are net of taxes, this implies that the expenditures on goods and services plus expenditures on leisure plus the value of household production are equal to the total value of time for the ith and jth persons, plus non-wage income.

The system of equations provided above implies that market hours are a function of wages and the full income definition provided in (2), so that $T_{iw} = f(w_i', w_j', Y_n')$. The

Slutsky is derived directly as a total differential of this expression

$$dT_{iw} = \frac{\partial T_{iw}}{\partial w_i'}\Big|_{(u-\bar{u})} dw_i' + \frac{\partial T_{iw}}{\partial w_j'}\Big|_{(u-\bar{u})} dw_j' + \frac{\partial T_{iw}}{\partial Y_n'}\left[T_{iw}dw_i' + T_{jw}dw_j' + dY_n\right], \tag{9}$$

which shows that the total change in market hours is composed of the own-wage compensated substitution effect plus the cross-wage compensated substitution effect, plus the full income effect (Keeley, 1981). Note that changes in the ith persons budget constraint due to an increase in the jth persons wage occur through private transfers in non-wage income.

The problem at hand is to show how the duration of unemployment and the unemployment rate alter the budget constraint and/or the shape of the indifference surfaces, which in turn alters both the reservation and expected wage rates. We can view the impact of the unemployment rate directly by assuming that the unemployment rate is the probability of not receiving a particular wage. Therefore, the expected wage for a representative individual can be written as

$$E(w) = (1-UN)\,\bar{w}, \tag{10}$$

where the expected wage has some distribution derived from the wage available in the market. Another way in which unemployment can alter the budget constraint is through asset income. During periods of high unemployment we expect that macroeconomic adjustments will be made in the money market, causing the interest rate to fall, which in turn will cause asset income to fall. Therefore, unemployment may affect the reservation wage, which can be simply expressed as

(11) $$\overline{w_r} = r(\overline{Y_t}, \overline{Y_a}),$$

where the reservation wage is for a representative individual, and therefore also has a distribution.

In this example, we shall assume that transfers received during the recession do not fully replace losses in asset and wage income. This implies that both income and compensated substitution effects will exist.

Given that the participation rate can be expressed simply as a function of the reservation wage and the expected wage

(12) $$LFPR = p(E(w), \overline{w_r}),$$

the net impact of unemployment rates on participation rates depends on whether the spread between the reservation and expected wages has increased or decreased for this representative individual. If the spread decreased, then observed participation rates should fall, or vice versa. For the average household in the United States, which has low levels of asset income relative to wage income, we would

generally expect that unemployment will cause decreasing participation.

As unemployment persists, households begin to consume their wealth. This causes non-wage income for jth persons to fall through the pooling of household income, which further reduces the reservation wage for all household members. It is likely that members within households will attempt to maintain the same level of utility in the face of increasing relative deprivation to a previous period, which implies participation of the jth person(s). This leads to the very common notion that households use their labor as a hedge against risk and uncertainty related to income (Blau and Grossberg, 1991; Coyte, 1986; Gonul, 1989; Hamermesh and Wolfe, 1990; Lundberg, 1985; Seitchik, 1991; Tokle and Huffman, 1991).

From a household income perspective, then, if the probability of the ith person earning a real wage falls, then the probability of receiving total household wage income also falls, causing expected household wage income to fall. Ceteris paribus, this means that both the ith and jth persons move to a lower indifference curve where $dw_i' < 0$ and $(\partial U_j/\partial Px_j)(\partial Px_j/\partial w_i) < 0$. The only way around this problem is if the jth persons enter the labor market.

From this discussion, the null hypotheses to be tested are 1) the duration of unemployment is positively correlated with labor force participation rates; 2) unemployment is negatively correlated with labor force participation rates;

and 3) service sector employment is negatively correlated with the duration of unemployment. These null hypotheses imply that the service sector is negatively affected by prolonged unemployment as are most other sectors of the economy and that the income effect is dominant as expected wages fall during prolonged periods of unemployment.

B. The Empirical Model

Panel data for all fifty states over the period 1985 to 1990 were used for this study. When testing for correlation between unemployment (UN), duration of unemployment (DU), service sector employment (SERV) and participation rates (LFPR) with this data, it is important to control for differences in populations that may change the shape and placement of the indifference set between states. A number of social variables were tested; however, the most significant of these were the percentage of the states eligible population classified as black or hispanic (MIN); the percentage of the state population with four-year college degrees or more (EDUC); and the percentage of the population over the age of 65 (AGE).

The budget constraint was somewhat difficult to set up due to the fact that asset income variables by state were not available. However, average weekly wages (RWAGE), per capita social security payments (PCSS), and average AFDC payments to

recipient households (AID) were used to represent the budget constraint.

Given that unemployment rates, wages, participation rates, AFDC payments, and Social Security payments are simultaneously determined in the market, fitted values of UN, AID, RWAGE, and PCSS were obtained through multivariate least squares to provide first-stage estimates and account for possible correlation between the error terms. The set of exogenous variables that was used for both included eight dummy variables to represent the nine census regions; percentage of employment in the manufacturing, service, and agricultural sectors; AGE; EDUC; MIN; DU; percentage of manufacturing workers under union contracts; a dummy variable designating whether the state is a right-to-work state; state employment ratio; state population; and five dummy variables representing the six-year period. All estimations provided a good fit: $R^2 = .86$ for UNH; $R^2 = .76$ for RWAGEH; $R^2 = .98$ for PCSSH; and $R^2 = .95$ for AIDH, where the "H" designates fitted variables.

The model specification that was selected for final analysis was a fixed-effects model, based on the Hausman specification error test, which overwhelmingly supported the fixed effect model with a probability of error of .00001. Further, a comparison between the fixed-effect and standard OLS estimates was facilitated by a pseudo-F test, which

supported the fixed-effect model with a probability of error of .00001 as well.

C. Results

The empirical results fail to reject hypothesis one and two; however, we can reject hypothesis three using a separate evaluation of the direct relationship between DU and SERV. Table 3 below provides a summary of the results by variable.

TABLE 3--LABOR FORCE PARTICIPATION AS A FUNCTION OF UNEMPLOYMENT AND DURATION OF UNEMPLOYMENT AND OTHER VARIABLES

Variable	Coefficient	t-statistic
Dependent Variable: LFPR		
PCSSH	.000041	3.02
AIDH	.00002	1.04
UNH	-2.655	-26.13
DU	.232	18.76
RWAGEH	.00022	2.40
EDUC	.113	1.39
AGE	-1.72	- 7.36
MIN	.138	5.29
R^2 = .84 (includes dummy variables for year)		

A separate fixed-effects model testing the third hypothesis regarding the correlation between service sector employment and the duration of unemployment was created with DU as the independent variable and UNH, SERV, and the change in the fitted wage (DRWAGE) as explanatory variables. Results are presented in Table 4 below.

TABLE 4--DURATION OF UNEMPLOYMENT AS A FUNCTION OF SERV, UNH, AND DRWAGE

Variable	Coefficient	t-statistic
Dependent Variable: DU		
SERV	1.200	4.13
UNH	3.71	11.61
DRWAGEH	- .00257	- 4.88
R^2 = .37		

D. Interpretation of Results

All of the signs associated with each of the variables can be explained using the model presented earlier. One would expect that, controlling for age, unemployment, and duration of unemployment, increasing Social Security payments cause non-wage income, and therefore the reservation wage, to rise.

Increasing wages create a positive incentive to participate in the market, as long as reservation wages are rising more slowly than wages. Hence the positive sign associated with wages. The AID coefficient is insignificant, and requires no further explanation.

As discussed earlier, increasing unemployment rates decrease the expected wage toward the reservation wage, and thus the negative sign. The positive sign associated with larger minority populations can be explained if we assume that minority groups have extremely low asset income on average, thus causing higher participation rates. The positive sign

associated with education levels can be explained by acknowledging that persons with higher levels of education also have higher opportunity costs associated with leisure, and, higher wages. Also, the negative sign associated with AGE means that when people approach retirement, they generally leave the labor force.

The variable of primary interest in Table 3 is DU. These results provide strong evidence supporting the added-worker effect as was discussed earlier. Given this information, households appear to have a significant desire to maintain standards of living. Comparing the size of the coefficients and t-statistics associated with UNH and DU, however, one could imply that the added-worker effect is overwhelmed by the discouraged worker effect.

Separate analysis of the participation rates of men and women was performed using the explanatory variables listed above. In both cases, significant positive coefficients associated with the duration of unemployment were found while significant negative coefficients were generated for the unemployment rate, as was found in the aggregated case. This implies that men and women are affected in the same way by the duration of unemployment and the unemployment rate. The DU coefficient for women was .23 (t=9.19), and the DU coefficient for men was .20 (t=5.0). We can conclude from these results that women are no longer the primary source of secondary workers that lead to the added-worker effect.

The coefficients presented in Table 4 suggest that the service sector growth is correlated with longer periods of unemployment, which in turn are associated with higher rates of participation. The primary explanation for this relationship is that higher participation rates are necessary to maintain family incomes in an environment of declining manufacturing and an expanding service sector, due to the lower wages paid in the service sector. This is the same result that was found by Nord in 1989, using 1980 data.

The policy implications of this result are that if manufacturing in the United States continues to fall, more persons will be required to enter the market to maintain a given standard of living. Clearly, this situation will cause a net welfare loss to society if household production of goods and leisure time are both reduced, unless household goods are replaced by purchased goods of equal value and the time intensity of leisure falls (Becker, 1965). If the last two conditions cannot be met, which is very likely, then it is clear that a national economic policy that targets industrial growth is justified.

E. Summary

This research shows that a significant income or added worker effect exists as the duration of unemployment increases. Although this effect exists, it is overwhelmed by a domirant substitution or discouraged worker effect. A

possible link is made between labor force participation rates and service sector employment through the duration of unemployment. Service sector employment is shown to be positively correlated with the duration of unemployment, which in turn is positively correlated with labor force participation.

Appendix (Chapter III)

All data related to wages, labor force participation, and employment by sector were collected from Employment and Wages: Annual Averages or Geographic Profile of Employment and Unemployment published by the Bureau of Labor Statistics. Data for all remaining variables were collected from the Statistical Abstract of the United States.

Eight dummy variables were created to represent nine regions in the first stage estimation of median household income and unemployment. These regions are defined as:

Region	State
New England (REG1)	Maine
	New Hampshire
	Vermont
	Massachusetts
	Rhode Island
	Connecticut
Middle Atlantic (REG2)	New York
	New Jersey
	Pennsylvania
East North Cent. (REG3)	Ohio
	Indiana
	Illinois
	Michigan
	Wisconsin
West North Cent. (REG4)	Minnesota
	Iowa
	Missouri
	North Dakota
	South Dakota
	Nebraska
	Kansas

South Atlantic (REG5)	Delaware
	Maryland
	Virginia
	W. Virginia
	N. Carolina
	S. Carolina
	Georgia
	Florida
East So. Cent. (REG6)	Kentucky
	Tennessee
	Alabama
	Mississippi
West So. Cent. (REG7)	Arkansas
	Louisiana
	Oklahoma
	Texas
Mountain (REG8)	Montana
	Idaho
	Wyoming
	Colorado
	New Mexico
	Arizona
	Utah
	Nevada
Pacific	Washington
	Oregon
	California
	Alaska
	Hawaii

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CHAPTER IV

THE RELATIONSHIP BETWEEN HOUSEHOLD SIZE AND LABOR FORCE PARTICIPATION RATES

To what extent, if any, does household size affect the labor force participation decisions of men and women in contemporary times? Becker (1965) argues that the allocation of time of any individual in a household depends on one's own opportunities and the opportunities of other household members. Over the past twenty-five years or so, the market opportunities and returns to women have greatly expanded. One could hypothesize, then, that decreasing household size in the United States is due in part to the increasing opportunity costs associated with child bearing.

A further argument could be made that household size is primarily responsible for the demand for household goods and services, from which we can derive the demand for time spent in household production. The purpose of this research is to test the hypotheses that: 1) increasing real wages are negatively correlated with birth rates; 2) household size is negatively correlated with participation rates for both men and women; and 3) that no difference exists between the impact of household on men's and women's labor force participation decisions.

A. Theoretical Development of the Null Hypotheses

The impact of household size and/or fertility on the leisure-market hours trade-off can be shown by maximizing a standard interdependent utility function, where consumption includes purchased and domestically produced goods and services which are a function of time spent in production of household goods. The connecting assumption to be tested is that time spent in production of household goods is positively related with household size, thus causing the participation rate to fall as household size increases.

The basic problem is to maximize an individual's utility

(1) $$U_i = f(l_i, C_i, U_j)$$

where l_i is leisure time, C_i is the value of the individual's consumption, and U_j is the utility of the jth person(s) in the household. Including the utility of the jth person forces interdependence of utility between family members.

Leisure time within the utility function is simply defined as:

(2) $$l_i = T - (T_{iw} + T_{iHP})$$

where T is total time available, T_w is time spent in wage earning, and T_{iHP} is time spent in individual non-wage production of household goods and services, noting that some of l_i and T_{iHP} may be time spent jointly with other household members.

Individual consumption, C_i, is composed of purchased goods and services, x_i, and the money value of goods and services produced by the household, Z_i. The value of C_i can be expressed as:

(3) $$C_i = Px_i + Z_i$$

where P is the price of consumer goods and services. The value of Z_i is assumed to be equal to the opportunity costs (disposable wages forgone) associated with the hours spent on household production, $Z_i = w_i' T_{iHP}$, where prime values indicate disposable wages and income. The value of household production of goods and services can be expressed as:

(4) $$Z = w_i' T_{iHP} + w_j' T_{jHP}$$

which implies that $Z = Z_i + Z_j$.

A production constraint is imposed on (4) through the time identity in (2). A budget constraint is imposed on consumption of x_i in that

(5) $$Px_i = C_{p_i} = Y_d - (S + C_{pj}),$$

where Y_d is the disposable income of the household, S is household saving, and C_{pj} is purchased consumption by the jth person(s).

The time constraint is directly tied to a budget constraint

(6) $$Y_d = ((T_{iw}w_i + T_{jw}w_j) + Y_{tr} + Y_a) - Taxes$$

where disposable household income depends directly on the time allocated to market hours by the ith and jth persons, the respective wages of these persons (w_i and w_j), transfers (Y_{tr}), asset income (Y_a) and taxes (Keeley, 1981). Through the optimization process, optimal market, household production, and leisure hours are jointly determined. We can break the problem down to the very simple expression $T_{iHP}^* = T - (l_i^* + T_{iw}^*)$ where T is fixed.

The demand for time in any of these three categories is derived from the variables in the utility function. Given the primary interests of this research, the utility of the jth individual, and the market hours of the jth person are of key importance. If the number of j persons increases in the household, then the number of hours spent caring for these persons will likely rise. This assumes that the time intensity of family care, which may or may not be linear over some range of j persons, is always positive. The need to allocate additional hours to household production will reduce optimal leisure and/or market time due to the finite nature of time. If the ith person reduces market time, then purchased

consumption for all persons in the household will fall, assuming that households pool all income.

On the other hand, if the ith person reduces individual leisure, then the utility of all persons in the household will fall due to the interdependence of utility functions. Therefore, whether increasing household size causes decreases or increases in market hours and participation by one or all eligible persons in the household depends on the relative magnitude of the coefficients associated with leisure, consumption, and U_j.

If there are diminishing returns associated with each of these activities, then increasing household size increases competition for consumption goods, which increases the marginal utility of purchased consumption for each individual. This same process causes the marginal utility of all time uses to increase, although by possibly different rates. The activity which will ultimately receive more time is the one with the highest marginal utility, which implies that one or both of the competing uses will receive less.

We can present these opposing effects of increasing household size graphically by assuming that T', the amount of time to be allocated between the market and leisure in a typical consumption-leisure model, falls to T" due to increasing T_{iHP}^{*}. If this occurs, then the reservation wage will rise, causing participation rates to fall for any given level of non-wage income and expected wage, assuming a fixed

set of indifference curves. This effect is shown in Figure 6.

A countering effect occurs because the marginal utility of consumption has increased over the entire range of possible consumption opportunities. This causes the indifference curve to flatten out, thus lowering the reservation wage and increasing participation, assuming that the marginal utility of leisure rises by less than the marginal utility of consumption. This adjustment in the indifference set also assumes that all non-earned income in the family is pooled and unchanging. This effect is shown in Figure 7. Both Figures 6 and 7 assume constant time intensities for leisure and work to finance consumption.

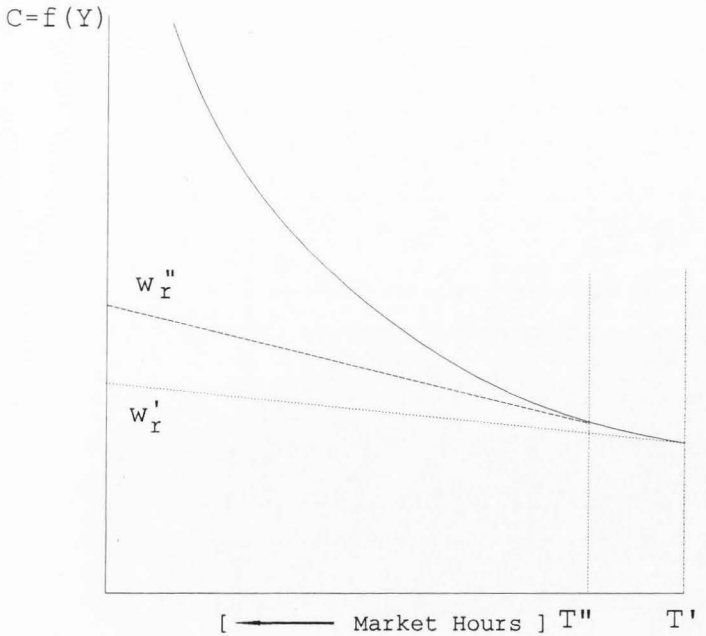

FIGURE 6. IMPACT ON THE RESERVATION WAGE DUE TO INCREASING DEMAND FOR HOUSEHOLD PRODUCTION

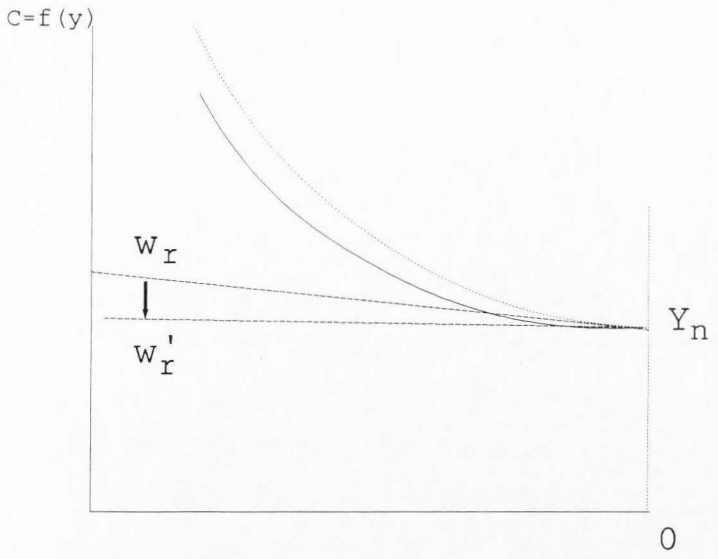

FIGURE 7. CHANGE IN THE RESERVATION WAGE DUE TO INCREASING MARGINAL UTILITY OF CONSUMPTION

B. The Empirical Model

We can test the first hypothesis in a straightforward manner, by explaining live births per 1000 population (BIRTH) as a function of real wages and other variables which capture social variations between states. Several variables were tested; however, the most significant of these were the

percentage of the population classified as hispanic and/or black (MIN), and percentage of the population over the age of 65 (AGE).

Panel data from all 50 states over the period 1985 to 1989 were used to test this hypothesis. A random-effects model was selected on the basis of a Hausman specification error test which showed that the fixed-effects model had a probability of specification error of .069, given a chi-square of 7.08, df=3.

We can test whether marginal utility of purchased consumption is greater-than or less-than the marginal utility of increasing household production as j increases, the second hypothesis, by evaluating the relationship between household size and the labor force participation rate, assuming that the marginal utility of leisure is constant. To do this, we must first develop a basic model of labor force participation. The first assumption is that the reservation wage is a function of average non-wage income, which can be simply defined as the average transfer payment plus average asset income.

Further, the expected wage for the representative individual is the average wage, conditioned by the probability of receiving that wage. The probability of receiving a given wage can be defined as one minus the unemployment rate. The discussion above assumes that the indifference set remains constant in shape and placement.

We can write the structural model as

(7) $$LFPR = p(E(w), \overline{w_r}),$$

(8) $$E(w) = (1 - UN)\,\overline{w},$$

(9) $$\overline{w_r} = r(\overline{Y_c}, \overline{Y_a}).$$

Given that this model is for a representative (average) individual, there exists a distribution around both the reservation and expected wages. Therefore, as these mean values start to converge, we would expect to observe greater overlap in their respective distributions, thus causing observed aggregate participation rates to fall.

Cross-section data for all fifty states in 1990 were used to test the second and third hypotheses. Panel data were not used due to the fact that accurate household size data are only available through the decennial census. It was decided that using the birth rate as a proxy for household size would not be appropriate as household size is determined by several factors not captured by the birth rate.

When testing for correlation between participation rates (LFPR) and household size (HHS) with these data, it is important to control for variations in income and other social differences between states.

The budget constraint was somewhat difficult to set up due to the fact that asset income variables by state were not available. Therefore, median household income (MHI) was used

on the assumption that it captures variations in all forms of income.

Given that unemployment rates, participation rates, and median household income are simultaneously determined in the market, fitted values of UN and MHI must be obtained to avoid simultaneity bias. The set of instruments that were used to estimate this two-stage least-squares model included the percentage of employment in the manufacturing, service, and agricultural sectors; percentage of the population over age 65; percentage of the population with four-year college degrees or more; percentage of the population identified as black and/or hispanic; percentage of manufacturing workers under union contracts; a dummy variable designating whether the state is a right-to-work state; state employment ratio; and state population. The AGE variable was also included in the estimated structural equation due to its significant explanatory power.

C. Results

The empirical results fail to reject the hypothesis that BIRTH is negatively correlated with real wage rates. This result supports the time allocation theories forwarded by Becker (1965), which include the general argument that the real wage represents the opportunity cost of time spent in rearing children. The results of the random-effects model are provided below in Table 5.

TABLE 5--LIVE BIRTHS PER 1000 AS A FUNCTION OF REAL WAGES AND OTHER VARIABLES

Variable	Coefficient	t-statistic
Dependent Variable: BIRTH		
RWAGE	- .00431	- 3.02
MIN	2.513	1.69
AGE	-63.693	- 9.53
C	24.51	24.99
R^2 = .30		
θ = .04		

Empirical analysis fails to reject the second hypothesis, that a negative relationship exists between household size and participation rates, but only for combined and female participation rates. In both of these cases a significant negative relationship exists between household size and the participation rate. No significant relationship exists, however, between household size and male participation rates, which allows us to reject the third hypothesis that the HHS impacts on men and women are equal. Results of the combined, male, and female models are presented as Tables 6, 7, and 8 below.

TABLE 6--COMBINED LABOR FORCE PARTICIPATION AS A FUNCTION OF HOUSEHOLD SIZE AND OTHER VARIABLES

Variable	Coefficient	t-statistic
Dependent Variable: LFPR		
MHI	.0000024	2.16
UN	-3.047	- 5.25
AGE	- .907	- 3.36
HHS	- .117	- 2.71
C	1.18	7.78
R^2 = .45		
F-statistic = 15.68		

TABLE 7--MALE LABOR FORCE PARTICIPATION AS A FUNCTION OF HOUSEHOLD SIZE AND OTHER VARIABLES

Variable	Coefficient	t-statistic
Dependent Variable: LFPRM		
MHI	.0000013	.33
UN	-2.60	- 3.61
AGE	- .859	- 2.56
HHS	- .066	- 1.23
C	1.14	6.04
R^2 = .28		
F-statistic = 7.05		

TABLE 8--FEMALE LABOR FORCE PARTICIPATION AS A FUNCTION OF HOUSEHOLD SIZE AND OTHER VARIABLES

Variable	Coefficient	t-statistic
Dependent Variable: LFPRF		
MHI	.000003	2.34
UN	-3.39	- 5.06
AGE	- .99	- 3.16
HHS	- .152	- 3.06
C	1.20	6.86
R^2 = .46		
F-statistic = 15.21		

D. Interpretation of Results

A significant negative relationship exists between real wages and fertility, accounting for variations between states. These results support the relationship predicted by Becker (1965), and Layard and Mincer (1985), that increasing wage rates provide a disincentive for having additional children. Given this information, we can explain that decreasing household size is due in part to increasing real wage opportunities for women.

The results presented above also show that while a negative correlation between household size and labor force participation exists for women, no significant relationship between these variables exists for men. This information supports the continuing existence of traditional roles of men and women in the family. It is also interesting to note that

household income is also insignificantly correlated with male participation rates, which further supports the notion of the "traditional" male role of market participation, regardless of the domestic situation.

Additional information that can be extracted from these results includes the fact that a positive relationship exists between female participation and household income. We cannot discover anything about the direction of causality given the cross-sectional nature of the data. However, theory suggests that the appropriate explanation is that as women enter the labor force, household income rises. If women entered the labor force due to increasing income, this would imply that increasing non-wage income, which increases the reservation wage, increases the probability of female participation. Clearly, this is not logical.

E. Summary

The findings of this research show that while household size is negatively correlated with labor force participation rates for women, no such relationship exists for men. These findings support the notion that traditional sex roles continue to exist in households. Real wage rates are negatively correlated with the number of live births per 1000 during the period 1985 to 1989 among the fifty states. This suggests that real wages represent an opportunity cost of bearing children.

Appendix (Chapter IV)

All data related to wages, labor force participation, and employment by sector were collected from Employment and Wages: Annual Averages or Geographic Profile of Employment and Unemployment published by the Bureau of Labor Statistics. Tax data were collected from the District of Columbia which completes a yearly cross-sectional study of effective tax rates in a publication called Tax Rates and Tax Burdens in the District of Columbia: A Nationwide Comparison. The number of live births per 1000 population, by state of residence were collected from Vital Statistics of the United States, which is published by the U.S. National Center for Health Statistics. Household Income Data are from Current Population Reports, series P-60, Number 174. Household size data are from the 1992 Statistical Abstract of the United States, table 60. Data for all remaining variables were collected from the Statistical Abstract of the United States.

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CHAPTER V

SUMMARY

This research has shown that labor force participation rates among the fifty states are not significantly correlated with any measure of state taxes, including an aggregate tax burden, income taxes, sales taxes or property taxes. This result is contrary to the view that taxes will only cause a compensated substitution effect in the aggregate, which, if correct, would have yielded negative coefficients with respect to taxes. This research found that no significant difference exists between the tax effects on female or male participation decisions.

This research also found that the duration of unemployment is positively correlated with labor force participation rates while the unemployment rate is negatively correlated. A link between participation rates, duration of unemployment, and service sector growth was made, showing a positive correlation between all three variables. Once again, no significant difference was found between men's and women's responses to these variables.

Additional findings of this research are that household size is significantly correlated with the labor force participation rate in the negative direction for women, although no such relationship exists for men. Real wages were

found to be negatively related with live births per 1000 population.

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CURRICULUM VITAE

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(March 1993)

EDUCATION:

Ph.D.-- Economics (Labor Economics) at Utah State University (GPA=3.9). Expected June 5, 1993.

M.S.S.--Economics/Management (GPA=3.75), Utah State University. Primary course work and research included public finance, management, and economic development. Degree awarded in 1988.

B.A. --Political Science (International Relations), Cum Laude, Boise State University. Degree awarded in 1986. This degree included 18 hours of Business and Economics Courses.

EXPERIENCE:

Teaching Assistant, Department of Economics, Utah State University (1991-present). By the time I graduate I will have taught Micro and Macro economic principles courses, Business Fluctuations and Forecasting, Managerial Economics, Labor Relations and Collective Bargaining, and Labor Economics.

Public Utility Rates Analyst, Department of Public Service, State of Minnesota (1990-91). My assignments included reviewing the economic impacts of current energy conservation programs and the use of financial incentives for DSM. I provided testimony before the Public Utilities Commission regarding these and other issues.

Instructor of Economics and Government (full time, tenure track), Snow College (1988-90). I taught courses in Foundations of Economics, Micro and Macro Economics, International Relations, American Government, and Comparative Government. I was selected by students as "Teacher of the Year" for 1988-89.

Research Assistant, Office of Business and Economic Development Services, Utah State University (1987-88). I worked in a community-based business retention and expansion pilot project for the State of Utah.